

FIG.1

Name			COM	COMPOSITION		(MASS	1.	ļ į	3	þ	HEAT TREATMENT *1
1 REMAINDER 20.0   - 2.5   1.0   - 0.5     -   -   -     2 REMAINDER 30.0   3.0   1.0   -   -   -   -   -   -   -   -     3 REMAINDER 35.0   - 2.5   1.0   2.0   -   -   -   -   -   -     4 REMAINDER 42.0   - 2.5   1.0   2.0   -   -   -   -   -   -     5 REMAINDER 20.0   - 2.5   1.0   6.5   -   -   -   -   -     6 REMAINDER 20.0   - 5.0   2.0   6.5   -   -   -   -   CARRIED     7 REMAINDER 20.0   - 5.0   2.0   6.5   -   -   -   CARRIED     8 REMAINDER 20.0   - 5.0   2.0   6.5   -   -   -   CARRIED     9 REMAINDER 20.0   - 5.0   2.0   6.5   -   -   -   CARRIED     1 REMAINDER 20.0   - 5.0   2.0   6.5   -   -   -   CARRIED     1 REMAINDER 20.0   - 5.0   2.0   6.5   -   -   -   CARRIED     2 REMAINDER 20.0   - 5.0   2.0   6.5   -   -   -   COO     3 REMAINDER 20.0   - 5.0   2.0   6.5   -   -   -   COO     4 REMAINDER 20.0   - 5.0   2.0   6.5   -   -   -   COO     5 REMAINDER 20.0   - 5.0   2.0   6.5   -   -   -   COO     6 REMAINDER 20.0   - 5.0   2.0   6.5   -   -   -   COO     7 REMAINDER 20.0   - 5.0   2.0   6.5   -   -   -   COO     8 REMAINDER 20.0   - 5.0   2.0   0.05     9 RASERIE	ŀ	Cu	Zn	F	$\rightarrow$	Si	딞	a '	Se Se	n	-
2         REMAINDER         3.0         3.0         1.0         -			20.0	1		0.1	†	2	-	1	-
3   REMAINDER   35.0   -   2.5   1.0   2.0   -   -   -   -   -   -   -   -   -		_	30.0	• •	•	1:0	1	, 	-		1
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$		L_	35.0	ı	•			-		'	1
S REMAINDER 42.0   - 2.5   1.0   6.5   -   -   -   -   -     1 REMAINDER 20.0   - 2.5   1.0   6.5   -   -   -   -   -   -     2 REMAINDER 20.0   - 5.0   2.0   6.5   -   -   -   CARRIED     3 REMAINDER 20.0   - 5.0   2.0   6.5   -   -   -   CARRIED     4 REMAINDER 20.0   - 5.0   2.0   6.5   -   -     CARRIED     5 REMAINDER 20.0   - 5.0   2.0   6.5   -   -     CARRIED     6 REMAINDER 20.0   - 5.0   2.0   4.2   -   -     CARRIED     7 REMAINDER 20.0   - 5.0   2.0   10.0   -     -     CARRIED     8 REMAINDER 20.0   - 5.0   2.0   10.0   -     -     CARRIED     9 RASE   PHASE   Mn-S1   100   SD (OR MORE)   *2   0.00     1		_	35.0	•	•		2.0	,	-	-	- 1
I REMAINDER 20.0   - 2.5   1.0   6.5   -   -   -   -   -     2 REMAINDER 20.0   - 5.0   2.0   6.5   -   -   -   CARRIED     3 REMAINDER 20.0   - 5.0   2.0   6.5   -   -   -   CARRIED     4 REMAINDER 20.0   - 5.0   2.0   6.5   -     -     CARRIED     5 REMAINDER 20.0   - 5.0   2.0   6.5   -     -     CARRIED     6 REMAINDER 20.0   - 5.0   2.0   4.2   -     -       -       7 REMAINDER 20.0   - 5.0   2.0   4.2   -     -             7 REMAINDER 20.0   - 5.0   2.0   4.2   -                 7 REMAINDER 20.0   - 5.0   2.0   4.2   -                   7 REMAINDER 20.0   - 5.0   2.0   4.2                   8 REMAINDER 20.0   - 5.0   2.0   4.2                   9 RAFIEL	5	_	42.0	-	•	1.0	2.0	-	,	'	
2         REMAINDER         20.0         -         5.0         2.0         6.5         -         -         CARRIED           3         REMAINDER         20.0         -         5.0         2.0         6.5         -         -         CARRIED           4         REMAINDER         20.0         -         5.0         2.0         6.5         -         0.05         CARRIED           5         REMAINDER         20.0         -         5.0         4.2         -         -         0.05         CARRIED           6         REMAINDER         20.0         -         5.0         10.0         -		<u> </u>	20.0	1		•	• • •	,	-	,	
3         REMAINDER         20.0         -         5.0         2.0         6.5         -         -         CARRIED           4         REMAINDER         20.0         -         5.0         2.0         6.5         -         0.05         CARRIED           5         REMAINDER         20.0         -         5.0         2.0         4.2         -         -         0.05         CARRIED           6         REMAINDER         20.0         -         5.0         2.0         4.2         -         -         -         -         -           7         REMAINDER         20.0         -         5.0         10.0         -	<u> </u>	┞-	20.0	<u> </u>		• 1	•	-	'	1	
4         REMAINDER         20.0         -         5.0         2.0         6.5         -         0.1         -         CARRIED           5         REMAINDER         20.0         -         5.0         2.0         4.2         -         -         0.05         CARRIED           6         REMAINDER         20.0         -         5.0         2.0         4.2         -         <			20.0				• 1	ı	1	'	ı
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$			20.0		1 •	2.0			0.1	١	
ER         20.0         -         5.0         2.0         -	-		20.0	L	5.0	2.0	۱ ۱	١.	-	0.05	- 1
ER 20.0 - 5.0 2.0 10.0	T.	↓_	20.0					-	1	ι	
COMPOUND (HV) SEIZURE (MPa)  Mn-Si 100 50 (OR MORE) *2  Mn-Si 125 20  Mn-Si 125 35  Mn-Si 180 50 (OR MORE)  Mn-Si 100 50 (OR MORE)  Mn-Si 150 50 (OR MORE)  Mn-Si 100 50 (OR MORE)	115	<b>_</b>	20.0	Ц	5.0			•	-	'	1
COMPOUND         HARDNESS (HAV) (HV)         LOAD NOT CAUSING SEIZURE (MPa)           Mn-S1         100         50 (OR MORE) *2           Mn-S1         125         20           Mn-S1         125         35           Mn-S1         180         35           Mn-S1         100         50 (OR MORE)           Mn-S1         150         50 (OR MORE)           Mn-S1         100         50 (OR MORE)           Mn-S1         100         50 (OR MORE)           Mn-S1         100         50 (OR MORE)		-			Ĺ	. **	MAX	IMUM	SPEC	IFIC	
Mn-Si         100         50 (OR MORE)         *2           Mn-Si         200         20         ()           Mn-Si         125         35         ()           Mn-Si         180         35         ()           Mn-Si         100         50 (OR MORE)         ()           Mn-Si         150         50 (OR MORE)         ()           Mn-Si         150         50 (OR MORE)         ()           Mn-Si         100         50 (OR MORE)         ()	Σ	ATRIX	COMP	QNNO	HARI (H)	ONESS v)	LOA	D NO.	r CAU (MPa	SING	WEAR (mm)
Mn-S1         200         20           Mn-S1         125         20           Mn-S1         125         35           Mn-S1         180         35           Mn-S1         100         50 (OR MORE)           Mn-S1         150         50 (OR MORE)           Mn-S1         150         50 (OR MORE)           Mn-S1         150         50 (OR MORE)           Mn-S1         100         50 (OR MORE)           Mn-S1         100         50 (OR MORE)	0 - DH	IASE	Æ	-S1	1	8	50	(OR	MORE)	*2	0.012
Mn-Si         125         20           Mn-Si         125         35           Mn-Si         180         35           Mn-Si         100         50 (OR MORE)           Mn-Si         150         50 (OR MORE)           Mn-Si         150         50 (OR MORE)           Mn-Si         150         50 (OR MORE)           Mn-Si         100         50 (OR MORE)           Mn-Si         100         50 (OR MORE)           Mn-Si         100         50 (OR MORE)	Z-PHAS	E+8-PHASE	Ã.	-S1	2	00		2	0.		0.003
Mn-Si         125         35           Mn-Si         180         35           Mn-Si         100         50 (OR MORE)           Mn-Si         150         50 (OR MORE)           Mn-Si         150         50 (OR MORE)           Mn-Si         150         50 (OR MORE)           Mn-Si         100         50 (OR MORE)           Mn-Si         100         50 (OR MORE)           Mn-Si         100         50 (OR MORE)	2-PHAS	E+ B-PHASE	Mn	-S1	1	25		,7	0		0.006
β - PHASE         Mn - Si         180         35           α - PHASE         Mn - Si         100         50 (OR MORE)           α - PHASE         Mn - Si         150         50 (OR MORE)           α - PHASE         Mn - Si         150         50 (OR MORE)           α - PHASE         Mn - Si         150         50 (OR MORE)           α - PHASE         Mn - Si         100         50 (OR MORE)           α - PHASE         Mn - Si         100         50 (OR MORE)	X-PHAS	E+8-PHASE	Ā	-Si		25		(.,	35		0.005
PHASE         Mn-Si         100         50 (OR MORE)           -PHASE         Mn-Si         150         50 (OR MORE)           -PHASE         Mn-Si         150         50 (OR MORE)           -PHASE         Mn-Si         150         50 (OR MORE)           -PHASE         Mn-Si         100         50 (OR MORE)           -PHASE         Mn-Si         100         50 (OR MORE)	A - DE	IASE	Mn	-Si	1	80		(.,	35		0.003
PHASE         Mn-S1         100         50 (OR MORE)           -PHASE         Mn-S1         150         50 (OR MORE)           -PHASE         Mn-S1         150         50 (OR MORE)           -PHASE         Mn-S1         100         50 (OR MORE)           -PHASE         Mn-S1         100         50 (OR MORE)	10- 0	IASE	M.	-Si		8	5		MOR	<u> </u>	0.010
-PHASE         Mn-Si         150         50 (OR MORE)           -PHASE         Mn-Si         150         50 (OR MORE)           -PHASE         Mn-Si         100         50 (OR MORE)           -PHASE         Mn-Si         100         50 (OR MORE)	a - Pr	TASE	Mn	-S1		00	5		MOR	(3	0.005
-PHASE         Mn-S1         150         50 (OR MORE)           -PHASE         Mn-S1         150         50 (OR MORE)           -PHASE         Mn-S1         100         50 (OR MORE)           -PHASE         Mn-S1         100         50 (OR MORE)		TASE	Mn	-Si	1	50	5		MOR	(E)	0.003
-PHASE         Mn-Si         150         50 (OR MORE)           -PHASE         Mn-Si         100         50 (OR MORE)           -PHASE         Mn-Si         100         50 (OR MORE)		HASE	Mn	-S1		.50	5		MOR	(ii	0.002
-PHASE Mn-S1 100 50 (OR MORE) -PHASE Mn-S1 100 50 (OR MORE)	ļ	HASE	Æ	-Si		.50	5		MOR	(E)	0.002
-PHASE Mn-S1 100 50 (OR MORE)		HASE	Mn	-S1	1	00	2	1	MOR	(E)	0.005
	Q - D	HASE	Æ	-S1		100	2		NOR.	田)	0.006

FIG.2

WHERE \*1 HEAT TREATMENT WAS CARRIED OUT AT 400 °C FOR 1 HOUR. \*2 MAXIMUM SPECIFIC LOAD WAS 50 MPa IN THE EXPERIMENT.

ITEM	CONDITIONS OF SEIZURE RESISTANCE TEST	UNIT
SAMPLE DIMENSIONS	$OD \times ID = \phi 25 \times \phi 21.7$	mm
NUMBER OF REVOLUTION	820	rpm
SPEED	1.0	m/s
LUBRICANT	SAE#30	1
LUBRICATING METHOD	OIL BATH	1
LUBRICANT TEMPERATURE	ROOM TEMP	ပ္စ
COUNTERPART MATERIAL	S55C	ı
COUNTERPART MATERIAL ROUGHNESS	NOT MORE THAN 0.3	Rz µm
COUNTERPART MATERIAL HARDNESS	≥ 560	НУ
144 44 147 A 1 mm m		

FIG.3

UNIT	mm	rpm	m/s	MPa	HOUR	1	ı	ပ္	•	Rz µm	HV
CONDITIONS OF WEAR RESISTANCE TEST	$OD \times ID = \phi 25 \times \phi 21.7$	8.2	0.01	10	8	SAE#30	OIL BATH	150	S55C	1.0	095≅
ITEM	SAMPLE DIMENSIONS	NUMBER OF REVOLUTION	SPEED	SPECIFIC LOAD	TIME	LUBRICANT	LUBRICATING METHOD	LUBRICANT TEMPERATURE	COUNTERPART MATERIAL	COUNTERPART MATERIAL ROUGHNESS	COUNTERPART MATERIAL HARDNESS

## FIG. 4